PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-132672
(43)Date of publication of application : 18.05.2001

(51)Int.Cl. F04C 18/344
F04C 2/344

(21)Application number : 11-313485
(22)Date of filing : 04.11.1999

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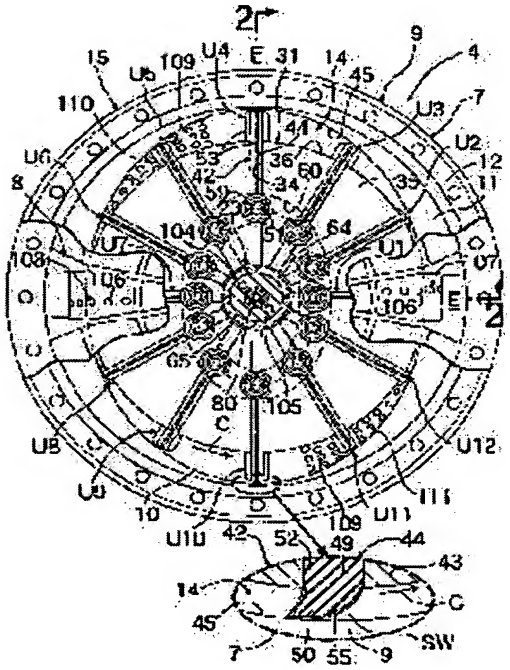
(54) VANE TYPE FLUID MACHINE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a vane type fluid machine capable of securing excellent sealing performance even if work accuracy of a casing inside surface is relieved by improving a structure of a seal part of respective vanes.
SOLUTION: This vane type fluid machine 4 has a casing 7, a rotor 31 for rotating in the casing 7 and plural vanes 42 for sliding on a casing inside surface 45 by being supported by the rotor 31. A seal part 50 of the respective vanes 42 is elastically deformably constituted so as to slide on the casing inside surface 45 in a state where the seal part 50 deflects toward the rear side in the rotor rotating direction C.



LEGAL STATUS

[Date of request for examination] 30.11.2005

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]
[Claim 1] Casing (7,120) and Rota turning around the inside of the casing (7,120) (31,123), In the blade type fluid machinery which has two or more blades (42,126) which are supported by the Rota (31,123) and slide on said casing inner surface (45 47; 134,135) The seal section (50,131) of each blade (42,126) is a blade type fluid machinery characterized by being constituted free [elastic deformation] so that it may slide on said casing inner surface (45 47; 134,135), after it has bent toward the backside [the Rota (hand of cut C)].
[Claim 2] Said seal section (50,131) of each blade (42,126) is a blade type fluid machinery according to claim 1 which consists of synthetic rubber which has thermal resistance.
[Claim 3] The blade type fluid machinery according to claim 1 or 2 which prepared the solid-state lubricating layer (55,132) in said seal section (50,131) front face of each blade (42,126).
[Claim 4] Said solid-state lubricating layer (55,132) is a blade type fluid machinery according to claim 3 which consists of an aggregate of two or more wafers which distributes and adheres to the front face of said seal section (50,131).
[Claim 5] Said solid-state lubricating layer (55,132) is a blade type fluid machinery according to claim 4 which consists of a diamond-like carbon film.
[Claim 6] Said blade (42,126) consists of a blade body (43,127) and a seal member (44,128) made of heat-resistant synthetic rubber prepared in the blade body (43,127). Said blade body (43,127) one configuration of a U character plate configuration and a plate configuration Have and said seal member (44,128) said seal section (50,131) formed successively by the applied part (49,130) with one form of U typeface with which said blade body (43,127) is equipped, and a KO typeface, and the periphery part of the applied part (49,130) The blade type fluid machinery according to claim 1 with which it has and the solid-state lubricating layer (55,132) which has many micro cracks is prepared in the front face of said seal section (50,131) that the elastic deformation of the seal section (50,131) should be permitted.
[Claim 7] Casing (7,120) and Rota turning around the inside of the casing (7,120) (31,123), In the blade type fluid machinery which has two or more blades (42,126) which are supported by the Rota (31,123) and slide on said casing inner surface (45 47; 134,135) Said blade (42,126) A blade body It consists of (43,127) and a seal member (44,128) made of heat-resistant synthetic rubber prepared in the blade body (43,127). On the seal section (50,131) front face of said seal member (44,128) the elastic deformation of the seal section (50,131) The blade type fluid machinery characterized by preparing the solid-state lubricating layer (55,132) which has many micro cracks that it should approve.
[Claim 8] Said blade body (43,127) is a blade type fluid machinery according to claim 7 which has said seal section (50,131) formed successively by the applied part (49,130) in which said seal member (44,128) has one form of U typeface with which said blade body (43,127) is equipped, and a KO typeface, and the periphery part of the applied part (49,130) by having one configuration of a U character plate configuration and a plate configuration.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Although this invention has a blade type fluid machinery, Rota which rotates the inside of casing and its casing especially, and two or more blades which are supported by the Rota and slide on said casing inner surface, it relates to amelioration.
[0002]
[Description of the Prior Art] Previously, as this kind of a fluid machinery, in casing of 2 rates, these people prepared the Rota chamber which makes the truck form for an abbreviation game in the virtual flat surface containing the Rota axis of rotation, and have propose the thing it was made to slide the seal section which makes the abbreviation U typeface of each blade to that Rota chamber inner surface (refer to a Japanese-Patent-Application-No. No. 57933 [11 to] description, and a drawing).
[0003]
[Problem(s) to be Solved by the Invention] In this case, if the minute level difference based on a gap of both the mating faces of minute concave, heights, or casing consists in the Rota chamber inner surface, said seal section consists of hard PTFE (polytetrafluoroethylene), and since it cannot deform so that it may imitate at these minute concaves, heights, etc., the seal nature between the Rota chamber inner surface and the seal section will be spoiled.
[0004] Then, as mentioned above, although precision processing had to be performed to the Rota chamber inner surface, since the Rota chamber was carrying out the special configuration, the precision processing took many working hours to it, and it had become the cause of this cost lifting of a fluid machinery.
[0005]
[Means for Solving the Problem] By improving the structure of the seal section of each blade, even if this invention eases the process tolerance of a casing inner surface, it aims at offering said blade type fluid machinery which enabled it to secure good seal nature.
[0006] In the blade type fluid machinery which has Rota which rotates the inside of casing and its casing according to this invention in order to attain said object, and two or more blades which are supported by the Rota and slide on said casing inner surface, the blade type fluid machinery constituted free [elastic deformation] so that the seal section of each blade may slide on said casing inner surface, after it has bent toward the backside [the Rota hand of cut] is offered.
[0007] Since the seal section will carry out elastic deformation so that those configurations may be imitated even if the minute irregularity section and a minute level difference are in a casing inner surface if the seal section of each blade is constituted as mentioned above, the seal nature between the seal section and a casing inner surface is securable.
[0008] Moreover, although the sliding calorific value serves as size and the endurance of the seal section will be spoiled when the planar pressure of the seal section goes up according to the centrifugal force accompanying a high-speed revolution of Rota, generating of such nonconformity is automatically avoided in the following operations. That is, at the time of a high-speed revolution of Rota, the dynamic pressure in the wedge space formed between the field by the side of before [of the seal section] the Rota hand of cut and a casing inner surface rises, and the dynamic pressure rises further, when the deformation of the seal section increases according to a centrifugal force. The

dynamic pressure moreover staged turns into thrust to the casing inner surface of the seal section, and according to deformation of the seal section, since the point of application of the thrust is displacing to the end face part side rather than a part for the point, as for the pressure which acts on a part for the point of the seal section, it falls. This can serve as control of planar pressure lifting of the seal section, can decrease the sliding calorific value, and can raise the endurance of the seal section dramatically. In addition, when the dynamic pressure in wedge space exceeds a design value, the seal section deforms greatly, misses a part for the excess of the dynamic pressure, and holds the dynamic pressure in wedge space to abbreviation regularity.

[0009]

[Embodiment of the Invention] In drawing 1 an internal combustion engine's 1 waste heat recovery system 2 The evaporator 3 which generates the steam which had lifting of the temperature and the pressure as a fluid achieved by making an internal combustion engine's 1 waste heat, for example, exhaust gas, into a heat source, i.e., a temperature-up pressure-up steam, The expander 4 as a blade type fluid machinery which generates an output by dilatation of the temperature-up pressure-up steam, It has the condenser 5 which liquefies the steam with which the temperature and the pressure after said dilatation which are discharged from the expander 4 descended, i.e., a temperature fall pressure-lowering steam, and the feed pump 6 which supplies the liquid from a condenser 5, for example, water, to an evaporator 3.

[0010] An expander 4 has special structure and is constituted as follows.

[0011] drawing 2 -5 -- setting -- casing 7 -- the [of metal / 1st] -- it consists of 2 half objects 8 and 9. Both **** 8 and 9 consist of a circular flange 12 of the subject 11 who has the crevice 10 of an abbreviation ellipse form, these subjects 11, and one, and the Rota chamber 14 of an abbreviation ellipse form is formed by piling up both the circular flange 12 through a metallic gasket 13. the [moreover,] -- subject 11 outside surface of 1 half object 8 is covered by the subject 16 who forms the deep bowl form of the shell form member 15 -- having -- **** -- the circular flange 17 of a subject 16 and one -- the -- it lays on top of the circular flange 12 of 1 half object 8 through a gasket 18, and three circular flanges 12, 12, and 17 are concluded with a bolt 19 in those circumferencial direction two or more parts. thereby -- the [the shell form member 15 and] -- the dilatation chamber 20 is formed between both the subjects 11 of 1 half object 8, and 16.

[0012] The subject 11 of both **** 8 and 9 has the hollow shaft receiver barrels 21 and 22 which project to the method of outside on those outside surfaces, and the major diameter 24 of the output shaft 23 of the hollow which penetrates the Rota chamber 14 to these hollow shaft receiver barrels 21 and 22 is supported pivotable through bearing metal 25. Thereby, the axis L of an output shaft 23 passes along the intersection of the major axis and minor axis in the Rota chamber 14 which makes an abbreviation ellipse form. moreover, the narrow diameter portion 26 of an output shaft 23 -- the -- it projects outside from the pore 27 which consists in the hollow shaft receiver barrel 22 of 2 half objects 9, and connects with a transmission shaft 28 through the spline association 29. The seal of between a narrow diameter portion 26 and a pore 27 is carried out with two seal rings 30.

[0013] Circular Rota 31 is held in the Rota chamber 14, the axial mounting hole 32 of the core and the major diameter 24 of an output shaft 23 have a fitting relation, and gear between both 31 and 24, and the bond part 33 is formed. Since axis of rotation of Rota 31 agrees with the axis L of an output shaft 23 by this, "L" is shared as a sign of the axis of rotation.

[0014] In the plurality prolonged in a radial from the axial mounting hole 32 focusing on that axis of rotation L, and this example, 12 slot-like space 34 is formed in Rota 31 at periphery good interval. Each space 34 has narrow circumferencial direction width of face, and it makes an abbreviation U typeface in the virtual flat surface which intersects perpendicularly with the ends side 35 so that opening may be carried out to the ends side 35 and peripheral face 36 of Rota 31 at a single string.

[0015] In each slot-like space 34, it is equipped with the 1st - the 12th blade piston units U1-U12 of the same structure free [reciprocation in the radiation direction] as follows. In the space 34 of an abbreviation U typeface, a stepped hole 38 is formed in the part 37 which divides the inner circumference side, and the type cylinder part material 39 with a stage which becomes the stepped hole 38 from a ceramic is inserted. The narrow diameter portion a end face of the cylinder part material 39 contacts major diameter 24 peripheral face of an output shaft 23, and is open for free passage to the through-hole c in which the minor diameter hole b carries out opening to major

diameter 24 peripheral face. Moreover, the guide cylinder 40 is arranged so that it may be located in the outside of the cylinder part material 39 on the member 39 and same axle. The heel of the guide cylinder 40 is stopped by opening of the space 34 which consists in Rota 31 peripheral face, and a toe is inserted in the major-diameter hole d of a stepped hole 38, and contacts the cylinder part material 39. Moreover, the guide cylinder 40 has the long slot e of the couple which carries out phase opposite and is prolonged [to / from the heel / near the toe], and both **** e face space 34. Fitting of the sliding of the piston 41 which consists of a ceramic in the major-diameter cylinder hole f of the cylinder part material 39 is made free, and the point side of the piston 41 is always located in the guide cylinder 40.

[0016] As shown in drawing 2 and 6, the cross section B of the Rota chamber 14 within the virtual flat surface A containing the axis of rotation L of Rota 31 consists of square cross-section section B-2 which connects one opposite edges of both of both the diameters g of the semicircle cross-section section B1 of the couple which made the diameter g counter mutually, and both the semicircles cross-section section B1, and both the opposite edges of another side, respectively, and is formed, and makes the truck form for an abbreviation game. In drawing 6 , the maximum cross section where a part indicated in solid line contains a major axis is shown, and, on the other hand, the minimum cross section where the part which showed the part according to the two-dot chain line contains a minor axis is shown. Rota 31 has the cross section [a little] D smaller than the minimum cross section which contains the minor axis of the Rota chamber 14 in drawing 6 as the dotted line showed.

[0017] A blade 42 consists of seal members 44 of the abbreviation plate configuration for U characters with which the blade body 43 and its blade body 43 of the abbreviation plate configuration for U characters were equipped so that it may show clearly in drawing 2 , and 5, 7-11.

[0018] spacing predetermined to the inner skin 45 according [the blade body 43] to the semicircle cross-section section B1 of the Rota chamber 14 -- with, spacing predetermined to the semicircle arc section 46 which counters, and the end face 47 in opposite by square cross-section section B-2 -- with, it has the parallel part 48 of the couple which counters. U-shaped gutter 52 which the minor axis 51 which projects to the method of outside is formed in the edge of each parallel part 48, and carries out opening to the periphery parts of the semicircle arc section 46 and both the parallel parts 48 toward the method of outside is formed in a single string, and the protruding line 53 of the couple of a segmental circle form cross section is further formed in both the flat-surfaces part of the semicircle arc section 46, respectively. It is arranged by both the protruding lines 53 so that it may be in agreement with the straight line to which the axis L1 of the virtual cylinder by them divides spacing between both the parallel parts 48 into two equally, and divides the semicircle arc section 46 into two equally in a hoop direction. Moreover, small projection of the toe of both the protruding lines 53 is carried out in the space between both the parallel parts 48, and the gap 54 between both the protruding lines 53 has extended in the semicircle arc section 46.

[0019] The seal member 44 is equipped with U typeface applied part 49 which has the rectangular section, and the seal section 50 which has a triangle cross section while being formed successively by the periphery part of the applied part 49. U-shaped gutter 52 of the blade body 43 is equipped with the applied part 49, the seal section 50 projects from U-shaped gutter 52, and it slides on the inner skin 45 by the semicircle cross-section section B1 of the Rota chamber 14, and the end face 47 in opposite by square cross-section section B-2.

[0020] The seal section 50 is constituted free [elastic deformation] so that it may slide on the inner surface of casing 7 therefore said inner skin 45, and the end face 47 in opposite, after it has bent toward the backside [the Rota hand of cut C], so that a part may be expanded to drawing 5 and it may be shown. Although the seal member 44 consists of synthetic rubber which has thermal resistance fundamentally, in the example, the solid-state lubricating layer 55 is formed in the front face of the seal section 50.

[0021] A perphloro elastomer is used as said synthetic rubber, and, on the other hand, as for the solid-state lubricating layer 55, coefficient of friction consists of small diamond-like carbon (DLC) film firmly.

[0022] The diamond-like carbon film used in this example means a coat to which a very broadcloth peak appears in both a coat to which a sharp peak appears in the graphite band of 1680cm-1, or the

diamond band of 1370cm-1, and a very broadcloth peak appears in another side or said graphite band, and a diamond band in a laser Raman spectrum. This is based on Jasco report vol.31, No.3, 49-53 (1989), the Okubo ******, and "assessment of the diamond film by Raman spectroscopy." Adhesion formation is carried out on seal section 50 front face under application of ion beam vacuum deposition, and a diamond-like carbon film constitutes the solid-state lubricating layer 55. Since the solid-state lubricating layer 55 will consist of the aggregates of two or more wafers which distribute and adhere to seal section 50 front face by this by many micro cracks arising at random, consequently the elastic deformation of the seal section 50 is permitted when the seal section 50 is sagged in this solid-state lubricating layer 55, as shown in drawing 5 , it imitates to said inner skin 45 grade of that, and a sex becomes good. In this case, the adhesion force of each wafer to the seal section 50 is high, therefore omission of each wafer are not produced.

[0023] Each blade 42 is stored in each slot-like space 34 in Rota 31 free [sliding], in that case, both the protruding lines 53 of the blade body 43 can be located in the guide cylinder 40, and the both-sides part of both the protruding lines 53 can be located in both **** e of the guide cylinder 40, respectively, and, thereby, the inner end face of both the protruding lines 53 can contact the outer edge surface of a piston 41. both the minor axes 51 of the blade body 43 -- the roller 59 of ball bearing structure -- a mounting eclipse and these rollers 59 -- the [1st] -- it engages with the circular sulcus 60 of the abbreviation ellipse form formed in the end face 47 in opposite of 2 half objects 8 and 9 respectively free [rolling]. Elliptical [of these circular sulci 60] has similar relation with elliptical [of the Rota chamber 14] so that it may show clearly in drawing 5 . Thereby, by collaboration with a roller 59 and a circular sulcus 60, while the gap between the end faces 47 in opposite of the gap between the inner skin 45 of the semicircle arc section 46 of the blade body 43 and the Rota chamber 14, each parallel part 48, and the Rota chamber 14 is held, respectively, relief of a friction loss is achieved. Moreover, since those gaps are filled with the seal member 44 at the time of a revolution halt of Rota 31 or are maintained at min, they can carry out the seal of said gap from the time of revolution initiation of Rota 31, or immediately after [its].

[0024] drawing 2 and 3 -- setting -- the major diameter 24 of an output shaft 23 -- the -- from the heavy-gage part 62 supported by the bearing metal 25 of 2 half objects 9, and its heavy-gage part 62 -- extending -- the -- it has a part for the thin-walled part 63 supported by the bearing metal 25 of 1 half object 8. The hollow shaft 64 which consists of a ceramic in a part for the thin-walled part 63 is attached so that it may rotate to an output shaft 23 and one. The fixed shaft 65 is arranged inside the hollow shaft 64. The fixed shaft 65 The major-diameter solid section 66 by which fitting was carried out to the hollow shaft 64 so that it might be settled in the direction thickness of an axis of Rota 31, It consists of the minor diameter solid section 69 by which fitting was carried out to the pore 67 which consists in the heavy-gage part 62 of an output shaft 23 through two seal rings 68, and a centrum 70 of the thin meat by which was prolonged from the major-diameter solid section 66, and fitting was carried out into the hollow shaft 64. the [the edge peripheral face of the centrum 70, and] -- a seal ring 71 intervenes between hollow shaft receiver barrel 21 inner skin of 1 half object 8.

[0025] In the subject 16 of the shell form member 15, the end wall 73 of the hollow barrel 72 which is in the core inner surface on an output shaft 23 and the same axle is attached through a seal ring 74. inner one end of the short outer case section 75 prolonged from the periphery section of the end wall 73 to the method of inside -- the -- it connects with the hollow shaft receiver barrel 21 of 1 half object 8 through the connection cylinder 76. It is a minor diameter and the long inner tube part 77 is formed in an end wall 73 so that it may be penetrated, and inner one end of the inner tube part 77 is attached in the stepped hole h which consists in the major-diameter solid section 66 of the fixed shaft 65 with the short hollow communication trunk 78 which projects from there. As for a part for the heel of an inner tube part 77, inner one end of a projection and the introductory tubing 80 for temperature-up pressure-up steams inserted in in the inner tube part 77 from a part for the heel is attached in the hollow communication trunk 78 from the pore 79 of the shell form member 15 to the method of outside. The cap member 81 is screwed on a part for the heel of an inner tube part 77, and the flange 83 of the holder cylinder 82 holding the introductory tubing 80 is stuck to the outer edge surface of an inner tube part 77 by the cap member 81 by pressure through a seal ring 84.

[0026] As shown in 4 and 12, 12 through-holes c are minded in the plurality which was formed in the major-diameter solid section 66 of the fixed shaft 65 at the cylinder part material 39 of the 1st -

the 12th blade piston units U1-U12, and was formed in the hollow shaft 64 and the output shaft 23 at a single string, and this example. drawing 2 - The device which supplies a temperature-up pressure-up steam, and discharges the 1st temperature fall pressure-lowering steam after dilatation through Through-hole c from the cylinder part material 39 is established as follows.

[0027] The 1st and 2nd pore 86 and 87 prolonged in an opposite direction is formed in ** from the space 85 which is open for free passage in the major-diameter solid section 66 at the hollow communication trunk 78, and opening of the 1st and 2nd pore 86 and 87 is carried out to the base of the 1st and 2nd crevice 88 and 89 which carries out opening to the peripheral face of the major-diameter solid section 66 so that it may show clearly in drawing 12 . The 1st and 2nd crevice 88 and 89 is equipped with the 1st and 2nd seal blocks 92 and 93 made from carbon which have feed hoppers 90 and 91, and rubbing of those peripheral faces is carried out to hollow shaft 64 inner skin. The taper peripheral faces i and j of the 1st and 2nd seal cylinders 96 and 97 which the 1st and 2nd pore 86 and the 1st and 2nd short supply pipe 94 and 95 which is on the same axle in 87 were inserted, and fitted into the head side peripheral face of the 1st and 2nd supply pipe 94 and 95 The feed hopper 90 of the 1st and 2nd seal blocks 92 and 93, It fits into the taper hole k which exists inside 91 and stands in a row in it, and m inner skin. Moreover, the 1st and 2nd annular crevices n and o which surround the 1st and 2nd supply pipe 94 and 95 in the major-diameter solid section 66, So that the 1st and 2nd foramen-cecum-ossis-forntalis-like crevices p and q which adjoin it may face the 1st and 2nd seal blocks 92 and 93 It is formed, and the 1st and 2nd bellows-like elastic bodies 98 and 99 are stored in the 1st and 2nd annular crevices n and o, and the 1st and 2nd coiled spring 100,101 is stored in the 1st and 2nd foramen-cecum-ossis-forntalis-like crevices p and q, respectively. The 1st and 2nd bellows-like elastic bodies 98 and 99 And the 1st and 2nd seal blocks 92 and 93 are pressed to hollow shaft 64 inner skin by the resiliency of the 1st and 2nd coiled spring 100,101.

[0028] Moreover, in the major-diameter solid section 66, the 1st and 2nd concave blowdown section 102,103 which is always open for free passage to two through-holes c, and the 1st and 2nd discharge hole 104,105 which is prolonged in the introductory tubing 80 and parallel from these blowdown section 102,103, and carries out opening into the centrum r of the fixed shaft 65 are formed between the 1st coiled spring 100, the 2nd coiled spring 101 of the row between the 2nd bellows-like elastic bodies 99, and the 1st bellows-like elastic body 98.

[0029] As it was called these 1st seal block 92 and the 2nd seal block 93, it is a member of the same kind, and that to which the "1st" alphabetic character was given, and the thing to which the "2nd" alphabetic character was given have the relation of point symmetry about the axis of the fixed shaft 65.

[0030] The inside of the centrum r of the fixed shaft 65 and the outer case section 75 of the hollow barrel 72 is the path s of the 1st temperature fall pressure-lowering steam, and the path s is open for free passage to the dilatation chamber 20 through two or more through-holes t which penetrate the peripheral wall of the outer case section 75.

[0031] it is shown in drawing 2 and 5 -- as -- the -- in the subject 11 periphery section of 1 half object 8, the 1st and 2nd installation holes 107,108 which consist of two or more introductory holes 106 radially located in a line are formed near the both ends of the minor axis of the Rota chamber 14, and the 2nd temperature fall pressure-lowering steam with which temperature and a pressure descended within the dilatation chamber 20 in the Rota chamber 14 from these installation holes 107,108 is introduced. the [moreover,] -- in the subject 11 periphery section of 2 half objects 9, the 1st derivation holes 110 which consist of two or more derivation holes 109 on a par with radial and a hoop direction are formed between the end section of the major axis of the Rota chamber 14, and the 2nd installation holes 108, and the 2nd derivation holes 111 which consist of two or more derivation holes 109 on a par with radial and a hoop direction are formed between the other end of a major axis, and the 1st installation holes 107. From these 1st and 2nd derivation holes 110,111, the 3rd temperature fall pressure-lowering steam with which temperature and a pressure descended further is discharged outside by dilatation between the adjacency **** blades 42.

[0032] The lubrication of the output-shaft 23 grade is carried out bywater, and the lubrication channel is constituted as follows. that is, it is shown in drawing 2 and 3 -- as -- the -- a feed pipe 113 is connected to the feed water hole 112 formed in the hollow shaft receiver barrel 22 of 2 half objects

9. the feed water hole 112 -- the -- the housing 114 which the bearing metal 25 by the side of 2 half objects 9 faces -- moreover, two or more water-flow slots v (also see drawing 12) where the water flow hole u is further prolonged in the direction of a peripheral face bus-bar of a hollow shaft 64 in the water flow hole u with which the housing 114 was formed in the heavy-gage part 62 of an output shaft 23 -- further -- again -- each water-flow slot v -- the -- it is open for free passage, respectively in the housing 115 which the bearing metal 25 by the side of 2 half objects 8 faces. Moreover, the annular crevice w which opens the sliding part between the major-diameter solid sections 66 of the water flow hole u, a hollow shaft 64, and the fixed shaft 65 for free passage is established in the end face in the heavy-gage part 62 of an output shaft 23.

[0033] The lubrication between casing 7, and the seal member 44 and each roller 59 is performed by the water which the lubrication between each axial metal 25 and an output shaft 23 and of between a hollow shaft 64 and the fixed shaft 65 was carried out bywater, and advanced into the Rota chamber 14 by this from the gap between the both-bearings metal 25 and an output shaft 23.

[0034] In drawing 4 , the 1st and 7th blade piston units U1 and U7 which have the relation of point symmetry about the axis of rotation L of Rota 31 perform same actuation. This is the same also about the 2nd and 8th blade piston unit U2 and U8 grade which have the relation of point symmetry.

[0035] For example, drawing 12 was also referred to, and it has shifted [whether the axes of the 1st supply pipe 94 are fewer than the minor-axis location E of the Rota chamber 14 to a counterclockwise rotation side in drawing 4 , and], and the 1st blade piston unit U1 is in said minor-axis location E, and a temperature-up pressure-up steam is not supplied to the major-diameter cylinder hole f, therefore a piston 41 and a blade 42 presuppose that it is in a retreat location.

[0036] If the drawing 4 counterclockwise rotation C, i.e., the Rota hand of cut, is made to rotate Rota 31 slightly from this condition, the feed hopper 90 and Through-hole c of the 1st seal block 92 will be open for free passage, and the temperature-up pressure-up steam from the introductory tubing 80 will be introduced into the major-diameter cylinder hole f through the minor diameter hole b. A piston 41 moves forward by this, and the forward motion is changed into rotation of Rota 31 when a blade 42 slides to the major-axis location F side of the Rota chamber 14. If Through-hole c shifts from a feed hopper 90, a temperature-up pressure-up steam will expand within the major-diameter cylinder hole f, a piston 41 will be advanced still more, and, thereby, a revolution of Rota 31 will be continued. Dilatation of this temperature-up pressure-up steam will be ended if the 1st blade piston unit U1 reaches the major-axis location F of the Rota chamber 14. After that, with a revolution of Rota 31, the 1st temperature fall pressure-lowering steam in the major-diameter cylinder hole f is discharged by the dilatation chamber 20 through the minor diameter hole b, Through-hole c, the 1st concave blowdown section 102, the 1st discharge hole 104, Path s (refer to drawing 3), and each through-hole t, when a piston 41 is retreated by the blade 42. In the dilatation chamber 20, by expanding still more, as the 2nd temperature fall pressure-lowering steam with which temperature and a pressure descended is shown in drawing 2 and 5, it is introduced in the Rota chamber 14 through the 1st installation holes 107, and the temperature fall pressure-lowering steam after [3rd] expanding further between the adjacency **** blades 42 and rotating Rota 31 is discharged outside from the 1st derivation holes 110.

[0037] Thus, an output is obtained from an output shaft 23 by operating a piston 41 by dilatation of a temperature-up pressure-up steam, and rotating Rota 31 through a blade 42, and rotating Rota 31 through a blade 42 by dilatation of the temperature fall pressure-lowering steam by the pressure drawdown of a temperature-up pressure-up steam.

[0038] If the inner skin 45 of the Rota chamber 14 and the end face 47 in opposite are slid in the condition of having constituted the seal section 50 of each blade 42 free [elastic deformation], and having bent as mentioned above the inner skin 45 grade -- the [the minute irregularity section or / 1st] -- since the seal section 50 carries out elastic deformation so that those configurations may be imitated even if there is a minute level difference with 2 half objects 8 and 9, the seal nature between the inner skin 45 of the seal section 50 and the Rota chamber 14 etc. is securable. On the other hand, the seal nature between U-shaped gutter 52 of the blade body 43 and the applied part 49 of the seal member 44 is secured with the elasticity of the applied part 49.

[0039] Moreover, as shown in drawing 13 , the dynamic pressure in the wedge space SW formed between the field of the solid-state lubricating layer 55 and the inner skin 45 of the Rota chamber 14

in the field by the side of before [of the seal section 50] Rota hand-of-cut C and the example at the time of a high-speed revolution of Rota 31 rises, and the dynamic pressure rises further, when the deformation of the seal section 50 increases according to a centrifugal force. The dynamic pressure moreover staged turns into thrust to the Rota chamber inner skin 45 of the seal section, and the pressure to which it acts on a part for the point of the seal section 50 since the point of application Z of the thrust is displacing to the end face part side rather than a part for the point according to deformation of the seal section 50 declines. This can serve as control of planar pressure lifting of the seal section 50, can decrease the sliding calorific value, and can raise the endurance of the seal section 50 dramatically. In addition, when the dynamic pressure in the wedge space SW exceeds a design value, the seal section 50 deforms greatly, misses a part for the excess of the dynamic pressure, and holds the dynamic pressure in the wedge space SW to abbreviation regularity.

[0040] According to the periodic-damping effectiveness by the bending even if a flutter ring furthermore arises in the seal section 50, since the planar pressure of the seal section 50 can be reduced, even if the solid-state lubricating layer 55 which becomes seal section 50 front face from a hard diamond-like carbon film exists, a stripes-like sleeve trace does not arise in the inner skin 45 of the Rota chamber 14, and the end face 47 in opposite.

[0041] When the seal member 44 is constituted from said synthetic rubber further again, since the coefficient of friction is comparatively large, depending on a sliding situation, the seal member 44 may separate from U-shaped gutter 52 of the blade body 43, and a gash may be generated in the seal member 44, but as mentioned above, if the solid-state lubricating layer 55 with small coefficient of friction is formed in the seal section 50, generating of said nonconformity is certainly avoidable.

[0042] Next, the sliding trial was performed about the seal member 44, and the amount x of bending of the seal section 50 and relation with coefficient of friction mu were investigated. Drawing 14 shows a test method and it is as follows. That is, a plate 116 is slid on an one direction at the rate of predetermined, as the seal section 50 of the seal member 44 held at the holder 117 equivalent to the blade body 43 is forced on the plate 116 equivalent to casing 7 by the predetermined load and an arrow head y subsequently shows to it from the lower part. This trial is in a dry condition among underwater, i.e., a wet condition, and atmospheric air that is, and was performed about the seal section 50 which has the solid-state lubricating layer 55, and the seal section 50 without it. In this case, a plate 116 is JIS. Consisting of [and] stainless steel shown by SUS316, a holder 117 is JIS. It consisted of stainless steel shown by SUS304. The seal member 44 consisted of said perphloro elastomers, and the solid-state lubricating layer 55 consisted of diamond-like carbon films with a thickness of about 1 micrometer. The sliding rate of a plate 116 was set as 0.5 m/s, and the press load of the seal section 50 was adjusted in the range of 0.3-3kgf according to the amount x of bending.

[0043] Drawing 15 shows a test result. It turns out that the coefficient of friction mu of the seal section 50 becomes small compared with the case where it does not have the solid-state lubricating layer 55 in a wet condition in a dry condition from drawing 15 if the solid-state lubricating layer 55 is formed in seal section 50 front face. Preferably, the coefficient of friction mu of the seal section 50 is mu<=0.3, and, for that purpose, on the other hand, sets the amount x of seal section 50 bending as x<=0.24mm in this example in a wet condition in a dry condition at x<=0.5mm.

[0044] Various kinds of configurations where the configuration of the seal section 50 is shown not only in said triangle cross section but in drawing 16 are applied. In drawing 16 , when it has a funnel shape cross section, and (b) has a blade form cross section, (a) forms a notch 118 in both hem parts, respectively, although it has a triangle cross section, and (c) corresponds, respectively, when said same notch 118 is formed in a crest side, although (d) has a blade form cross section when it is made easy to bend the seal section 50.

[0045] In using said expander 4 as a compressor The drawing 4 clockwise rotation is made to rotate Rota 31 with an output shaft 23. By the blade 42 The open air as a fluid is inhaled in the Rota chamber 14 from the 1st and 2nd derivation holes 110,111. In this way The low compressed air which were obtained by carrying out is supplied to the major-diameter cylinder hole f through the dilatation chamber 20, each through-hole t, Path s, the 1st and 2nd discharge hole 104 and 105, the 1st and 2nd concave blowdown sections 102 and 103, and Through-hole c from the 1st and 2nd installation holes 107,108. By moreover, the blade 42 A piston 41 is operated, the low compressed air is changed into the high compressed air, and the high compressed air is introduced into the

introductory tubing 80 through Through-hole c, feed hoppers 90 and 91, and the 1st and 2nd supply pipe 94 and 95.

[0046] Drawing 17 shows the vane pump 119 as a blade type fluid machinery. The casing 120 consists of a cylindrical shape casing main body 121 and two annular end plates 122 formed in the ends. Cylindrical shape Rota 123 was held in casing 120, and, as for the axis L3 of the revolving shaft 124, only epsilon has shifted from the center line L4 of casing 120. Rota 123 has three blade slots 125 formed in periphery good spacing, and is inserted in these blades slot 125 free [sliding of the blade 126 which slides on the casing inner surface 134, i.e., the inner skin of a casing main body 121, and the inner surface 135 of the ends plate 122].

[0047] As shown in drawing 18 , 19 and drawing 20 , and 21, each blade 126 consists of a blade body 127 and a seal member 128 made of heat-resistant synthetic rubber prepared in the blade body 127. The blade body 127 has a plate configuration, the longer edge section and both ****** are covered, and a series of KO typeface slots 129 are formed. The seal member 128 has the seal section 131 formed successively by the KO typeface applied part 130 with which the KO typeface slot 129 of the blade body 127 is equipped, and the periphery part of the applied part 130. An applied part 130 has the rectangular section, and the seal section 131 has a triangle cross section in said this appearance. The solid-state lubricating layer 132 which has many micro cracks is formed in the front face of the seal section 131 at said this appearance that the elastic deformation of the seal section 131 should be permitted. A perphloro elastomer is used for said this appearance as heat-resistant synthetic rubber, and the solid-state lubricating layer 132 is constituted from a diamond-like carbon film by said this appearance.

[0048] Although the predetermined gap is prepared in consideration of the thermal expansion of Rota 123 under operation in the usual vane pump between the end face 133 of Rota 123, and it and the inner surface 135 of the end plate 122 which counters If the above seal members 128 are used, said gap can be filled with the seal member 128 at the time of a Rota 123 revolution halt, or it can be made min, and, thereby, the seal of said gap can be carried out from the time of revolution initiation of Rota 123, or immediately after [its].

[0049] A vane motor, a blower, a sliding vane compressor, etc. are contained in a blade type fluid machinery out of the aforementioned thing.

[0050]

[Effect of the Invention] According to this invention, even if it eases the process tolerance of a casing inner surface by specifying the structure of the seal section of each blade as mentioned above, the blade type fluid machinery which enabled it to secure good seal nature can be offered.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the schematic diagram of an internal combustion engine's waste heat recovery system.
[Drawing 2] With drawing of longitudinal section of an expander, it is equivalent to the 2-2 line sectional view of drawing 5 .
[Drawing 3] It is the expanded sectional view of the circumference of axis of rotation of drawing 2 .
[Drawing 4] It is the 4-4 line sectional view of drawing 2 .
[Drawing 5] It is the 5-5 line sectional view of drawing 2 having shown the important section with the expanded sectional view.
[Drawing 6] It is the explanatory view showing the Rota chamber and the cross-section configuration of Rota.
[Drawing 7] It is the front view of a blade body.
[Drawing 8] It is 8 view drawing of drawing 7 .
[Drawing 9] It is the 9-9 line sectional view of drawing 7 .
[Drawing 10] It is the front view which expanded a part of seal member, and fractured the part.
[Drawing 11] It is the 11-11 line expanded sectional view of drawing 10 .
[Drawing 12] It is the enlarged drawing of the circumference of axis of rotation of drawing 4 .
[Drawing 13] It is the explanatory view showing the gestalt of the seal section and dynamic pressure distribution under Rota revolution.
[Drawing 14] It is the explanatory view of a sliding test method.
[Drawing 15] It is the graph which shows the amount x of bending of the seal section, and relation with coefficient of friction mu.
[Drawing 16] It is the sectional view with various configurations of the seal section.
[Drawing 17] It is the decomposition perspective view of a vane pump.
[Drawing 18] It is the front view of a blade body.
[Drawing 19] It is 19 view drawing of drawing 18 .
[Drawing 20] It is the front view which expanded a part of seal member, and fractured the part.
[Drawing 21] It is 21 view drawing of drawing 20 .
[Description of Notations]
4 ..... Expander (blade type fluid machinery)
7,120 ..... Casing
31,123 .... Rota
42,126 .... Blade
43,127 .... Blade body
44,128 .... Seal member
45,134 .... Inner skin
47 ..... End face in opposite
49,130 .... Applied part
50,131 .... Seal section
55,132 .... Solid-state lubricating layer
119 ..... Vane pump
135 ..... Inner surface

C ..... Rota hand of cut

[Translation done.]

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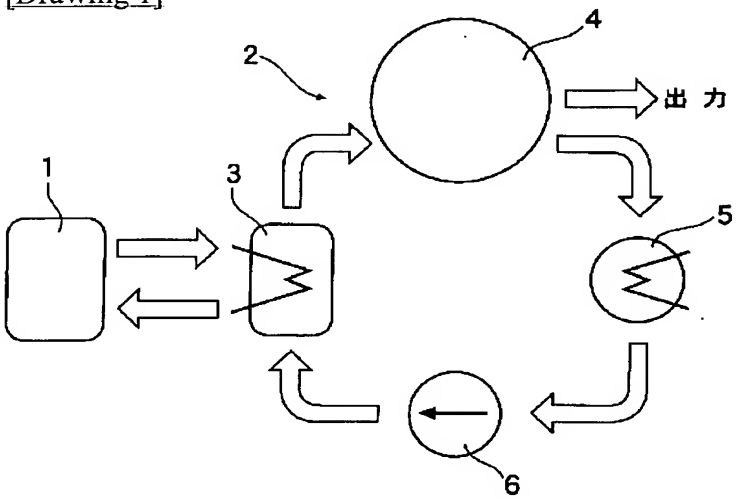
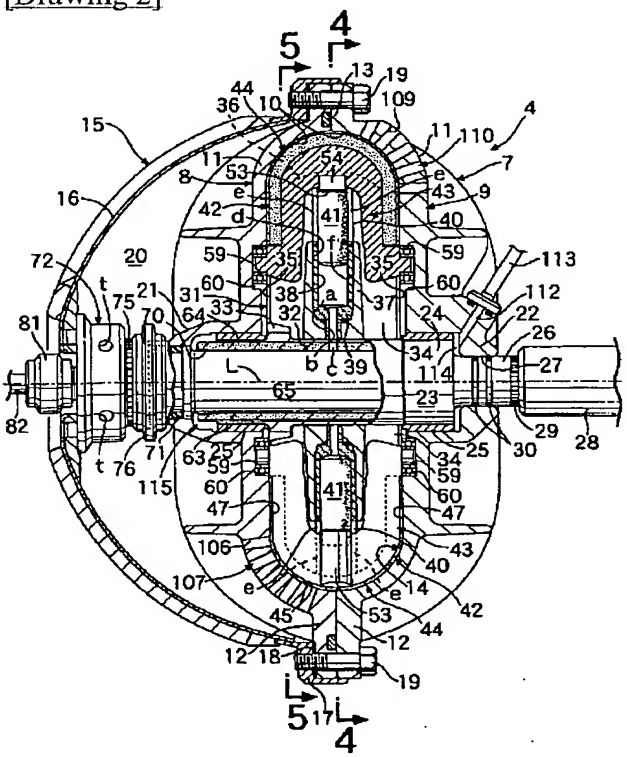
DRAWINGS

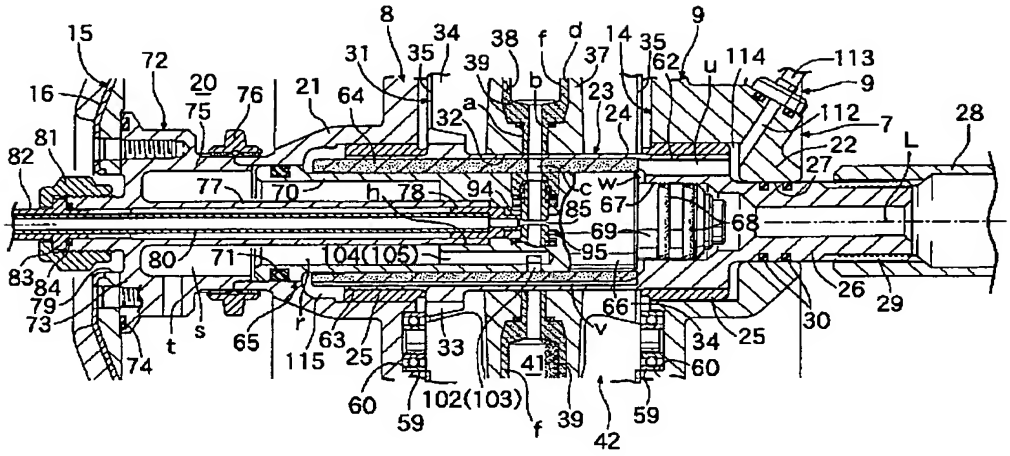
[Drawing 1]



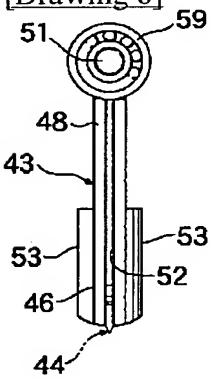
[Drawing 2]



[Drawing 3]



[Drawing 8]



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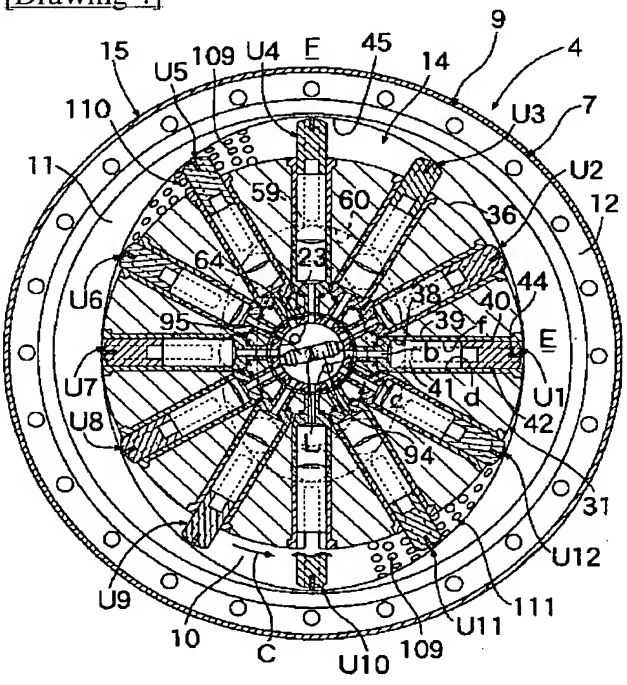

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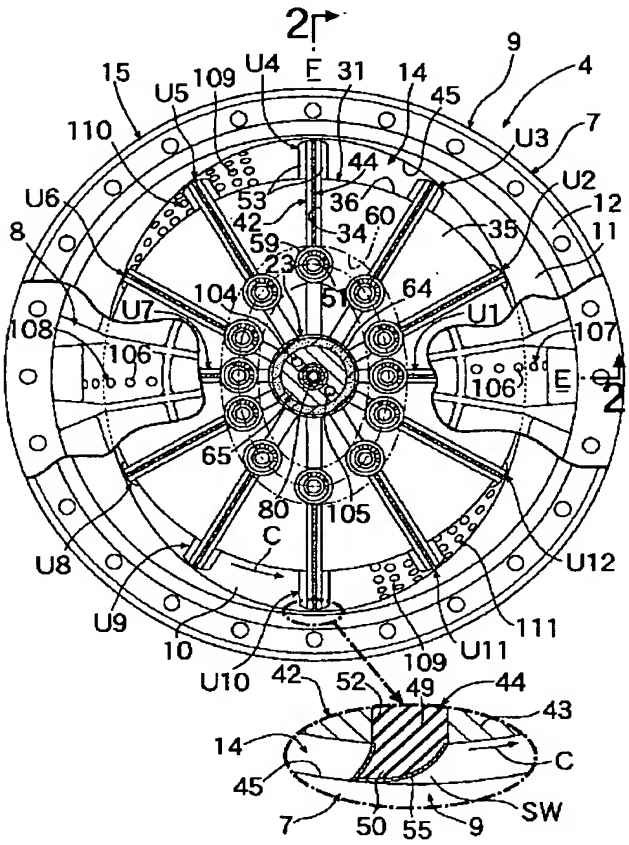

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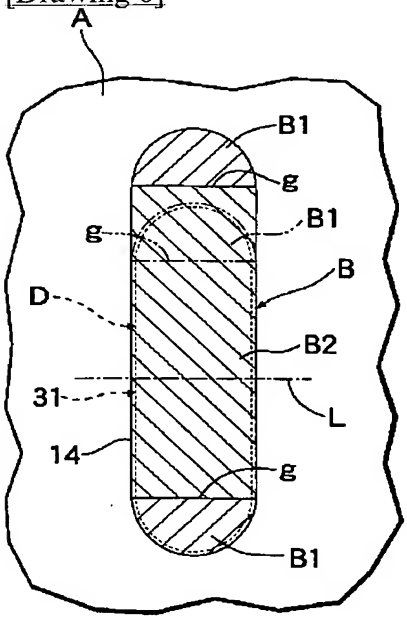

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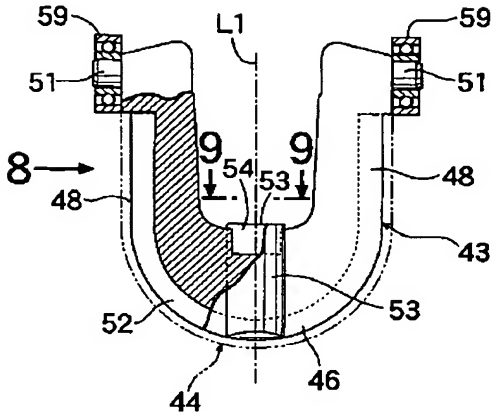

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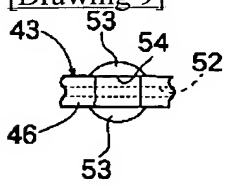

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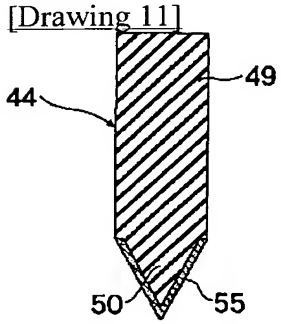
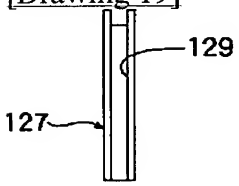
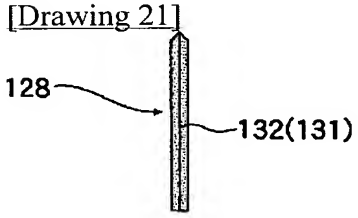


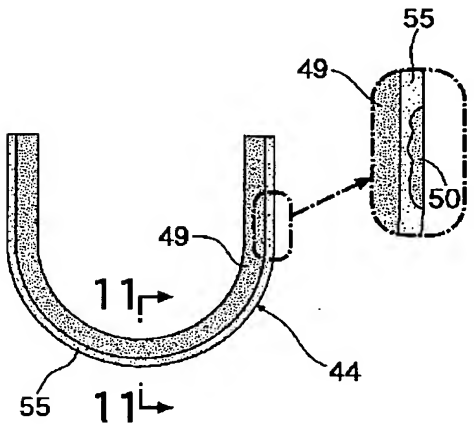
[Drawing 19]



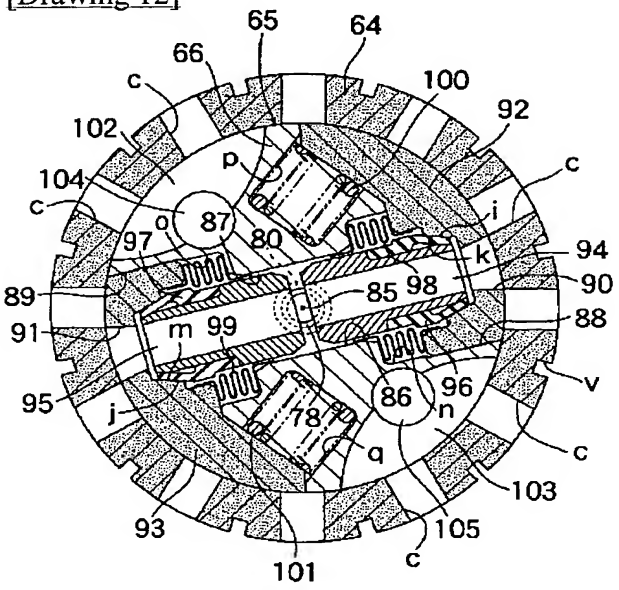
[Drawing 21]



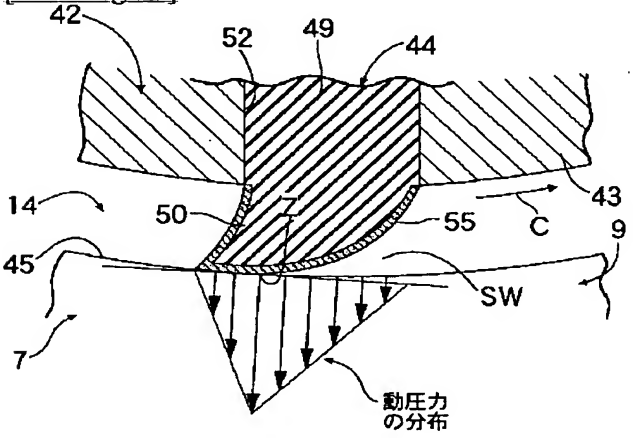
[Drawing 10]



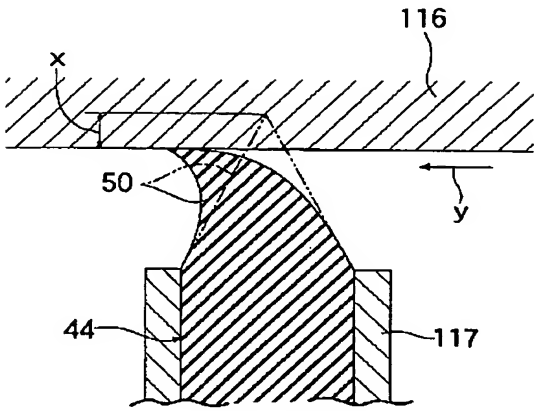
[Drawing 12]



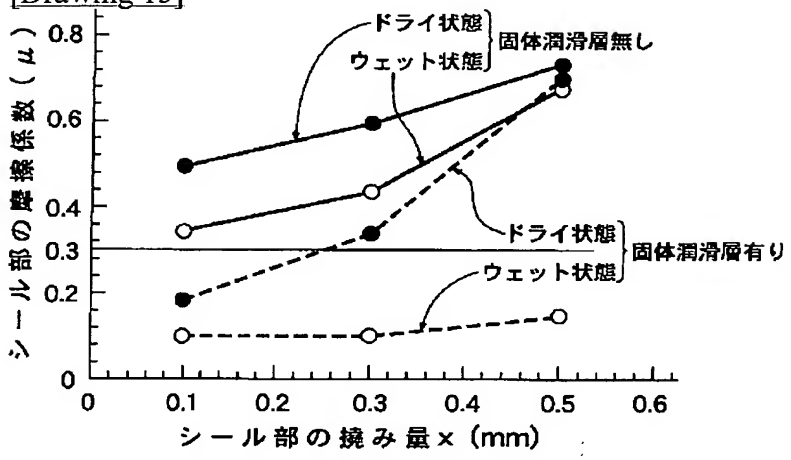
[Drawing 13]



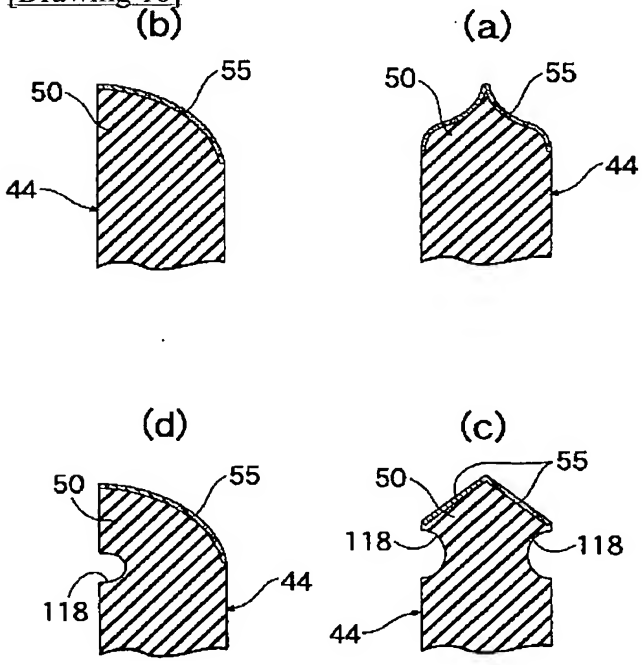
[Drawing 14]



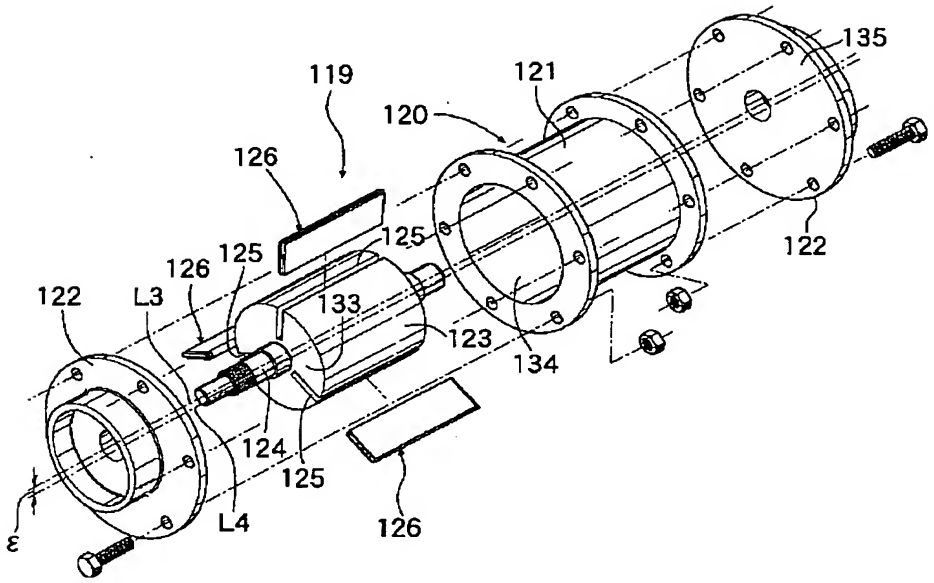
[Drawing 15]



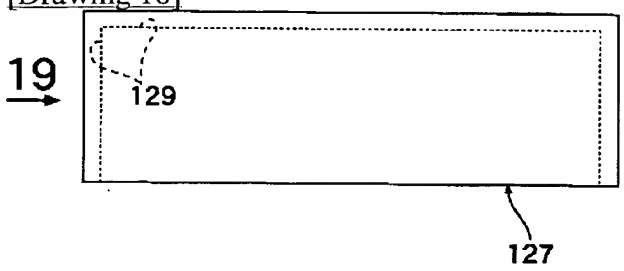
[Drawing 16]



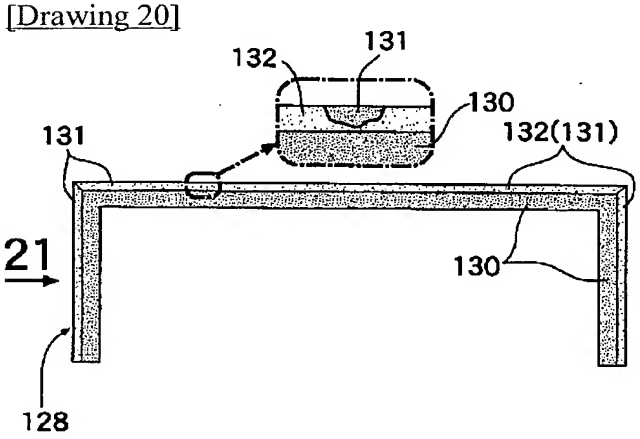
[Drawing 17]



[Drawing 18]



[Drawing 20]



[Translation done.]